REMARKS

In the Office Action, the Examiner rejected Claims 1-20, which are all of the pending claims, under 35 U.S.C. 112 as being indefinite. Claims 1-7 and 9-20 were further rejected under 35 U.S.C. 103 as being unpatentable over the prior art, principally U.S. Patent 5,777,773 (Epworth, et al.). Claims 1 and 19 were also rejected under the doctrine of obviousness-type double patenting as being unpatentable over various claims of each of U.S. Patents 6,738,187, 6,751,014 and 6,597,840. In addition, the Examiner noted a minor informality in Claim 8.

More specifically, with respect to the rejection of the claims under 35 U.S.C. 103, Claims 1-6 and 9-20 were rejected as being unpatentable over Epworth, et al alone, and Claim 7 was rejected as being unpatentable over Epworth, et al. in view of U.S. Patent 6,674,558 (Chang, et al.). Claim 8, it may be noted, was not rejected over the prior art.

The above-identified rejections of the claims under 35 U.S.C. 103 and 112 and under the doctrine of double patenting are respectfully traversed. Editorial changes are being made to Claims 2, 10 and 17 to improve the form and readability of these claims. Also, Claim 8 is being rewritten in independent form, including the limitations of Claim 1, and the informality noted by the Examiner in Claim 8 is being corrected.

For the reasons discussed below, all of Claims 1-20 patentably distinguish over the prior art, and patentably distinguish over the claims of U.S. Patents 6,738,187, 6,751,014 and 6,597,840. Moreover, all of the Claims 1-20 are clear and definite within the meaning of 35 U.S.C. 112. The Examiner is thus asked to reconsider and to withdraw the above-identified rejections of Claims 1-20 under 35 U.S.C. 112, and the rejections of Claims 1-7 and 9-20 under 35 U.S.C. 103. The Examiner is also asked to reconsider and to withdraw the rejections of Claims 1 and 19 under the doctrine of

double patenting, and to allow Claims 1-20.

In order to best address the rejections of the claims, Applicants believe it may be helpful to briefly discuss this invention.

The present invention, generally, relates to modulating the optical signals transmitted within an optical network in order to encode information, preferably control information, in those signals. As discussed in the present application, lambda switching technology is used to transmit many high speed data streams over a common fiber optic cable, and conventional lambda switching proposals require a separate wavelength channel to be reserved for advertising network information to the attached devices.

This switching procedure has several disadvantages. For instance, a failure in the laser transmitting this wavelength for a device means that the device is no longer visible to the network. Also, it is not efficient to remove bandwidth from the network to implement the lambda switching controls.

The present invention effectively addresses these problems by enabling an optical network to carry control information redundantly over each wavelength that is also carrying network data. This is done by taking an optical signal that is carrying network data, and modulating the wavelength of that optical signal such that this wavelength modulation represent data, such as control data. In this way, the same optical signal can carry both network and control data. More specifically, the center wavelength of the optical signal is modulated so that a difference exists between that center wavelength and another, predefined wavelength such as the center wavelength of a filter mechanism through which the optical signal is directed.

A mechanism and procedure are provided, in accordance with the preferred embodiment of the invention, to process and decode the optical signal at a receiver of the optical network. This is done to extract from the optical signal the information encoded therein.

In the Office Action, in rejecting the claims - and specifically, the independent Claims 1, 9, 13, 15, 17 and 19 - under 35 U.S.C. 112, the Examiner argued that it is not clear how the difference is established between the center wavelength of the optical signal and the center wavelength of the filter mechanism or another predefined wavelength. The Examiner noted that the specification discloses the use of a photodetector, but that it was unclear how the above-described difference is established.

There are a number of ways to establish this difference. One way to do this is explained in the specification from page 5, line 24 to page 6, line 7. There, and with reference to Figure 2 of the application, it is explained that the wavelength of a laser diode 22 is controlled by a current from a source 24, and the laser voltage bias is modulated by a dithering current from signal generator 26. Variations in the laser bias produce a corresponding dither in the center wavelength of the laser output 30.

The manner in which the laser output is used, in a preferred embodiment of the invention, is discussed in the specification from page 6, line 9 to page 7, line 5. There, it is explained that the laser output is directed through a bandpass filter having its own center wavelength. A portion of the output of this filter is directed to a photodetector, which generates a signal representing the offset between the laser and filter center wavelengths. This photodetector output can be used as part of a feedback loop to control or adjust the extent and polarity of the difference between the laser and filter center wavelengths. This difference can be used to represent, or "encode," information.

For example, in Claims 1 and 9, the invention modulates the center wavelength of an optical signal, which is then passed through a bandpass filter; the resulting signal is detected by a photodetector and processed using a vector inner product to generate a bipolar signal, where the amplitude of the bipolar signal is proportional to the offset between the nominal laser center wavelength and the filter center wavelength and continuous variation of this bipolar signal may be used to represent data values.

Likewise, in Claims 4 and 12, the feedback signal is used to adjust the offset between the laser center frequency and the filter center frequency.

Likewise, in Claim 5, the optical signal may be amplitude modulated by various means to carry a first set of data, while the bipolar signal may be modulated separately to carry a second set of data values.

Thus, the photodetector output is not used so much, by itself, to modulate the optical signal (instead items 22, 24 and 26 are used to do this), but rather to adjust the extent and polarity of that modulation. Also, with particular regard to Claims 4 and 12, Applicants wish to note that the "dither signal" that is adjusted by the feedback signal is the output of 24, not the output of 26.

In the Office Action, the Examiner specifically questioned Claim 5, which describes the feature that the optical signal may carry two sets of data. This aspect of the invention is discussed in the specification on page 6, lines 9-16. As explained there, one set of data can be carried in a conventional manner by, for example, modulating the amplitude of the optical signal. The second set of data can be carried, by implementation of the present invention, by modulation of the center wavelength of the optical signal. Neither set of data is modulated. Rather, each set of data is represented by a respective modulation (such as amplitude and wavelength) of the optical signal.

The Examiner also questioned Claim 8, and argued that it is not clear how the difference between wavelengths is established by encoding the given data. In this regard, it may be helpful to note that this difference is not established not so much by encoding data. Instead, this difference is established, in the preferred embodiment of the invention and as discussed above, by means of current source 24, voltage bias source 24 and signal generator 26, and this difference represents data.

In view of the foregoing, it is believed that the specification clearly teaches how the desired difference is established between the center wavelengths of the optical signal and another predefined wavelength, such as the center wavelength of the filter mechanism and how that difference is used to represent or encode data.

Applicants' attorneys have carefully reviewed the specification and Claims 1-20, and these claims are clear and definite. Moreover, these claims are consistent with the description in the specification, and that description teaches how to practice the claimed invention. The Examiner is, accordingly, asked to reconsider and to withdraw the rejection of Claims 1-20 under 35 U.S.C. 112.

As mentioned above, Claim 8 has been rewritten in independent form including the limitations of Claim 1. Also, as the Examiner has suggested, in the penultimate paragraph of Claim 8, the first occurrence of "value" has been deleted. In view of these changes, it is believed that Claim 8 is now in condition for allowance.

In addition, it is the establishment and use of the above-described difference between the center wavelength of the optical signal and another predefined wavelength, or the center wavelength of the filter mechanism that distinguish the claims of this application from Epworth, et al. and the three patents cited by the Examiner in the double patenting rejection.

With respect to the double patenting rejections, as the Examiner has observed, several claims of U.S. Patents 6,751,014, 6,738,187 and 6,597,840 describe modulating the center wavelengths of optical signals. These claims do not describe, though, the feature of using that modulation to encode or represent data. This feature is described in Claims 1 and 19 of the present application, and this feature is of significant utility because, as discussed above, it allows a single wavelength to carry plural sets of data.

Accordingly, Claims 1 and 19 of the present application patentably distinguish over Claims 1-4, 15-18, 21, 22, 31 and 32 of U.S. Patent 6,738,187, Claims 1, 18 and 20 of U.S. patent 6,751,014 and Claims 1, 2, 13, 14, 25, 26, 28 and 29 of U.S. Patent 6,597,840. The Examiner is, thus, respectfully asked to reconsider and to withdraw the double patenting rejections of Claims 1 and 19.

With respect to the rejections of Claims 1-7 and 9-20 over the prior art, there are a number of important differences to note between this invention and Epworth, which go beyond the Office Action assertions that Epworth does not disclose a center wavelength on his laser or filter, as follows:

Epworth describes a dither induced frequency modulation of a laser source. However, the resulting feedback signal discriminates only that portion of the dither induced amplitude modulation (after passing through the filter), which is in phase quadrature with the applied dither (see Abstract for Epworth). Further, Epworth locks the peak of a narrowband component to a filter response curve by driving an error signal to zero (Col. 1, lines 59-60, and Col. 2, lines 19-23).

This approach is therefore a peak locking scheme, for stabilization of the source by driving an error signal to zero, not a modulation scheme for imposing a data value on a bipolar error signal as described in this application. The approach described by Epworth detects only a single condition

(quadrature phase locking) and thus cannot be used to encode data. By contrast, in the present application, the inventors propose using a range of wavelength modulation states (the bipolar signal) to encode data in the changing wavelength - the wavelength may be changed to one of a predetermined number of states depending on the data being transmitted. The system described in the present application detects a plurality of states in the bipolar signal, and in this way, can, for example, put different data can be put on different wavelengths, and the destination of the signal can be controlled in an MPLS based wavelength routing network, which is not possible using the scheme proposed by Epworth.

Note that the Office Action on page 9, paragraph 2, makes an error in describing Epworth when it is stated that "varying intensity of the bias signal of the laser will alter the intensity of the dither signal as well". This is only true if the dither signal is an amplitude modulation; Epworth is using the dither as a frequency modulation (see their Abstract), thus, the dither is not affected by changing the laser bias signal.

On the same page of the Office Action, last paragraph, the Examiner argues that Epworth discloses using modulating with a second set of data. It appears, however, that Epworth does not disclose modulating with a second set of data (the Office Action does not cite a reference for this in Epworth). Rather, Epworth speaks of both frequency modulation with a dither signal (which does not contain any data) and amplitude modulation with an external modulation (which does contain data). The preferred embodiment of this invention is distinguished from Epworth since this invention, preferably, modulates both the data stream (as in Epworth's external modulator) and the wavelength difference between the laser and filter wavelength (which is not described in Epworth).

On page 10 of the Office Action, paragraph 2, regarding Claims 13 and 15, it is noted that Epworth generates a difference signal and converts it to a data value, which is used to control the laser. This is not the same as proposed in the preferred embodiment of this invention, as that embodiment generates a bipolar signal (not a difference signal) and convert it to a modulated data value (not a control parameter). For example, Epworth is not capable of modulating their error signal in order to place different amplitude modulated data onto different optical wavelengths, as enabled by the preferred embodiment of this invention. As noted previously, Epworth is designed as a control system, not a modulator (Column 1, paragraph 1 and Column 2, lines 52-55). Also note that the control dither in Epworth produces a steady state error (Column 2, line 52-55), which is not present in the present disclosure.

On page 11 of the Office Action, it is noted that Epworth's dither modulation encodes data into the optical signal. This is incorrect; Epworth's dither modulation simply introduces a periodic frequency modulation in the laser, which does not carry any useful information. The dither modulation is later converted to an amplitude modulation when passing through a filter, and this signal is processed by Epworth to provide a feedback control mechanism. By contrast, the present application describes modulation of the laser and filter offset signal in the same manner as a digital data stream; the laser and filter offset signal (or bipolar signal) can be varied to produce meaningful data (such as the address destination, which may be required for a given data packet).

Independent Claims 1, 9, 13, 15, 17 and 19 describe important features not shown or suggested in the prior art. Specifically, Claims 1 and 17 set forth the step of modulating the center wavelength of the optical signal to establish a difference between the center wavelengths of the filter mechanism and the optical signal, or between the center wavelength of the optical signal and a

predefined wavelength, to represent a data value or to encode a data value into the optical signal. Claim 9, which is directed to apparatus for encoding data in an optical signal, includes a modulation system to modulate the center wavelength of the optical signal to establish a difference between the center wavelengths of the filter mechanism and the optical signal to represent a data value.

Claims 13 and 15 describe features of the receiver side of the optical network. Claim 13 describes the steps of generating a difference signal representing the difference between the center wavelengths of the optical signal and a filter mechanism, and converting that difference signal to a data value. Claim 15, which is directed to an apparatus for decoding an optical signal including a center wavelength, describes analogous apparatus limitations.

Independent Claim 19 describes aspects of both the transmit side and the receive side of the optical network. In particular, this Claim sets forth a transmit device for modulating the center wavelength of the optical signal to establish a difference between the center wavelength and a predefined wavelength to encode data in the optical signal.

As is apparent from the above-discussion, the prior art neither discloses nor suggests the modulating steps of claims 1 or 17, or the modulating system of Claim 9. Likewise, the references do not disclose or suggest the manner in which the optical signal is processed and used, as described in Claims 13 and 15, or the transmit device of claim 19.

Because of the above-discussed differences between Claims 1, 9, 13, 15, 17 and 19 and the prior art, and because of the advantages associated with those differences, these claims patentably distinguish over the prior art and are allowable. Claims 2-7 are dependent from Claim 1 and are allowable therewith; and Claims 10-12 are dependent from, and are allowable with, Claim 9. Similarly, Claims 14, 16, 18 and 20 are dependent from, and are allowable with, Claims 13, 15, 17

and 19 respectively. Accordingly, the Examiner is asked to reconsider and to withdraw the rejections of Claims 1-7 and 9-20 under 35 U.S.C. 103, and to allow these claims.

In view of the foregoing, it is believed that this application is in condition for allowance. The Examiner is asked to reconsider and to withdraw the rejections of Claims 1-20 under 35 U.S.C. 112 and the rejections of Claims 1-7 and 9-20 under 35 U.S.C. 103. The Examiner is further asked to reconsider and to withdraw the double patenting rejections of Claims 1 and 19 and the objection to Claim 8, and to allow Claims 1-20. If the Examiner believes that a telephone conference with Applicants' Attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,

John S. Sensny
John S. Sensny
Registration No. 28,757
Attorney for Applicants

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza – Suite 300
Garden City, New York 11530
(516) 742-4343

JSS:jy